DMSO
TEST AND EVALUATION FUNCTIONAL WORKING GROUP WORKSHOP

PROCEEDINGS

26 - 28 JULY 1992

MCLEAN, VA

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REPORT ORGANIZATION

This report presents the results of the Test and Evaluation Workshop in developing Modeling and Simulation needs for the T&E community. The executive summary provides an overview of the background, objectives, and organization of the workshop and summarizes the workshop results. The body presents the workshop background and objectives, describes the working groups, process and products, and provides an expanded summarization of the workshop results.

The appendices represent the contributions of the individual work groups which were used to produce the final results. Appendix A lists the M&S policy, management, and technical needs as consolidated by the Executive Panel convened following the workshop. Appendix B lists the workshop participants. The Visions for M&S, developed by the services and agencies work groups, are presented in Appendices C through F for the Army, Navy, Air Force and Defense Agencies Working Groups. The Integrated Vision and Needs, as developed by the Policy, Management and three Technical Working Groups, are given in Appendices G through K . Appendices M, N, and O contain the Policy, Management, and Technical Needs as briefed in the workshop final session. An Overview of the Requirements Survey for T&E, M&S, conducted by TRW in preparation for and used during the workshop, is given in Appendix O.

EXECUTIVE SUMMARY

INTRODUCTION

The Defense Modeling and Simulation Office (DMSO) sponsored the Test and Evaluation (T&E) Modeling and Simulation (M&S) Requirements Workshop as one in a series of workshops in five functional areas (Education, Training, and Military Operations; Research and Development; Test and Evaluation; Production and Logistics; and Analysis). The Director, Test and Evaluation, and the DMSO invited the Services and Agencies to provide suggested attendees to the T&E M&S Requirements Workshop. The output from this workshop will be used by the T&E Functional Working Group (FWG) to guide the DMSO in promoting the effective and efficient use of modeling and simulation in the Department of Defense.

Participants were asked to identify and prioritize policy, management, and technical requirements. Requirements were categorized into activities that should be funded now and those that should be funded in the future.

The workshop was conducted 28-30 July 1992 at the MITRE Corporation facilities in McLean, Virginia.

An outbriefing was provided to the Service Principals and Agencies and the Director, T&E on 30 July 1992.

A briefing was presented to the SES Executive Review Committee on 9 September 1992.

T&E WORKSHOP OBJECTIVES

- The primary objective of this workshop was to develop a prioritized set of T&E community needs for modeling and simulation support.
- An additional objective was to allow users from throughout the T&E community to exchange information and develop a shared vision of the future.

METHODOLOGY/WORKSHOP ORGANIZATION

A sequence of intermediate products was developed over a series of workshop sessions that lead to the final workshop report.

Session 1:	Service visions of future T&E most effectively and efficiently utilizing M&S
Sessions 2&3:	Integrated service visions and elaborated needs
Session 4:	Policy, Management and Technical prioritized sets of needs and final briefing

Session 5: Service discussions, impacts, and recommendations

SUMMARY OF WORKSHOP-IDENTIFIED T&E M&S REQUIREMENTS

1. Verification, Validation, and Accreditation (VV&A)

   - DMSO should support the development of better VV&A tools.
   - T&E community needs to take leadership role in VV&A of current M&S.
   - Each service should establish its VV&A requirements for models, simulations, and data bases used in T&E.

2. Standard M&S and Databases

   - DMSO should support development of M&S standards and require approved architectures, standards, and protocols for future joint M&S.
   - DMSO should demand improvement in Ada or take action to adopt another language for use in M&S.
   - T&E community needs to support development of standard functional area models.
   - Each service should implement and enforce M&S standards for T&E.

3. Education

   - T&E community needs to provide educational opportunities for T&E practitioners, the acquisition work force, and decision makers on the application of M&S to T&E.

4. Information Sharing

   - DMSO should require a M&S library to support T&E across the DOD.
   - T&E community needs to support information sharing on M&S support of T&E to include establishing M&S user groups.
   - Services should provide centralized coordination of the T&E M&S efforts.

5. Networks

   - DMSO should support the development and use of distributed, real-time processing with man- or hardware-in-the-loop capability
   - Defense agencies, with requirements from the T&E community, need to provide the network capabilities to link sub-surface, surface, air, and space systems.

6. Jointness

   - DMSO is to encourage development of models and simulations that incorporate both vertical and horizontal integration.
   - Services are encouraged to use models and simulations that are capable of simulating joint operations.

7. Multi-Level Security

   - T&E community needs to work with appropriate Defense Agencies to determine security requirements for T&E M&S.

8. Planning for the Use of M&S

   - DMSO needs to provide cost effectiveness data and metrics to support the use of M&S.
   - Services are encouraged to establish a T&E M&S Utilization Plan for system development and acquisition between Milestone Zero and Milestone One. The M&S Utilization Plan should be updated at each milestone.

9. M&S Development

   - DMSO is to support use of M&S in T&E by supporting advances in software.
   - T&E should encourage the development of modes and simulations that are capable of real-time T&E applications.

10. Industry Developments

    - T&E community should be aware of and ready to leverage activities being performed by private industry to develop new and improved products, particularly in the areas of computer hardware and graphical output.

11. Developer Tools and Handbook

    - DMSO is to support use of M&S in T&E by development of a M&S developers handbook.

INTRODUCTION TO T&E WORKSHOP RESULTS

INTRODUCTION

INTRODUCTION

The Defense Modeling and Simulation Office (DMSO) sponsored the Test and Evaluation (T&E) Modeling and Simulation (M&S) Workshop, reported in this document, as a forum to identify T&E M&S requirements.

The vision for modeling and simulation support to T&E is to make combat system development and testing significantly more cost effective. By 1998, both development and operational testing will consist of significantly more simulation and significantly less hardware and or field testing. Virtual reality will be a reality. Much of the test and evaluation of aircraft, ships, and armor will take place in the hanger, at the dock, and in the tank park. M&S will have the credibility so that decisions can be based on simulation results that are verified by limited field tests.

A basic infrastructure will be developed to support integration of M&S into T&E community activities. System-level M&S will grow with the system during the development and acquisition cycle. The system-level simulations are expected to "net" with other systems or simulations. System plans will include M&S for development, T&E, production and logistics, and training.

Common architectures, standards, and protocols will permit the interoperability of T&E models and simulations.

It is hoped that the results of this workshop will support the development of a rationalized M&S development plan that will bring about the "vision" of M&S support to T&E quickly and cost effectively.

BACKGROUND

- T&E Modeling and Simulation Workshop is one of five workshops sponsored by the DMSO
- Invitation to T&E Modeling and Simulation Workshop from the Director, Test and Evaluation, and the DMSO
- Participants of T&E Modeling and Simulation Workshop identified actions required to produce better modeling and simulation support to T&E
  - Policy actions
  - Management actions
  - Technical actions

BACKGROUND

The DMSO sponsored the T&E M&S Requirements Workshop as one in a series of workshops in five functional areas (Education, Training, and Military Operations; Research and Development; Test and Evaluation; Production and Logistics; and Analysis). The output from this workshop will be used by the Test and Evaluation Functional Working Group to guide the DMSO in promoting the effective and efficient use of modeling and simulation in the Department of Defense.

The Defense Director, Test and Evaluation, and DMSO invited the Services to provide suggested attendees to the T&E M&S Requirements Workshop. (The Workshop invitation is in Attachment 1.)

Participants were asked to identify and prioritize policy, management, and technical requirements. Requirements addressed activities that should be funded now and those that should be funded in the future.

A consolidation of all M&S policy, management, and technical needs is provided in Appendix A.

The list of workshop participants in presented in Appendix B.

The workshop was conducted 28-30 July 1992 at the MITRE Corporation facilities in McLean, Virginia.

An outbriefing was provided to the Service Principals and Agencies and the Director, T&E on 30 July 1992.

A briefing was presented to the SES Executive Review Committee on 9 September 1992.

T&E WORKSHOP OBJECTIVES

- The primary objective of this workshop was to develop a prioritized set of T&E community needs for modeling and simulation support
- An additional objective was to allow users from throughout the T&E community to exchange information and develop a shared view of the future

T&E WORKSHOP OBJECTIVES

The objectives of the workshop were as stated above.

WORKING GROUP PROCESS AND PRODUCTS
— WORKING GROUPS —

- Day 1, Session 1: Service groups
  - Army
  - Navy
  - Air Force
  - DOD Agencies
- Day 2, Sessions 2 & 3: Functional area working groups
  - Policy
  - Management
  - Three technical groups
- Day 3, Session 4: Two combined groups
  - Policy and Management
  - Technical
- Day 3, Session 5: Service groups
  - Army
  - Navy
  - Air Force
  - DOD Agencies

WORKING GROUP PROCESS AND PRODUCTS
— WORKING GROUPS —

Working groups were organized to represent Service and Agency views, then to obtain functional perspectives of policy, management, and technology requirements. To ensure that the end user of modeling and simulation for T&E was not lost, Service and Agency groups reviewed the workshop results in the last session.

WORKING GROUP PROCESS AND PRODUCTS
— SESSIONS —

- A sequence of intermediate products was defined that lead to the final workshop report
- Session 1: Service visions of future T&E most effectively and efficiently utilizing M&S
- Sessions 2&3: Integrated service visions and elaborated needs
- Session 4: Policy, Management & Technical prioritized set of needs & final briefing
- Session 5: Service discussions, impacts, and recommendations

WORKING GROUP PROCESS AND PRODUCTS
— SESSIONS —

The purpose of Session 1 was to allow individual services to meet and articulate their views of future modeling and simulation support of T&E. The Service and Agency "vision" reports are provided in Appendices C through F.

Sessions 2 and 3 had functional groups that addressed policy, management, and technology capability needs in light of the Service and Agency views presented in Session 1. The functional working group results are provided in Appendices G through K.

Session 4 combined the Policy and Management groups to reach consensus on needs and prioritization of those needs. The Technology groups were merged to reach requirements and priorities for technology needs. The reported Policy and Management Needs are included in Appendices L and M. The reported Technical Needs are provided in Appendix N.

Session 5 provided Service and Agency review of the policy, management, and technology needs reported out of Session 4.

WORKING GROUP PROCESS AND PRODUCTS — GROUPING OF ACTIVITIES —

- **DMSO**

  Activities that should be performed by and/or funded by DMSO — T&E community should take advantage of (leverage) DMSO actions

- **T&E Community**

  Activities that should be performed separately by the T&E community or through the DMSO process

- **Services/Agencies**

  Activities that should be performed within and/or funded by each service and agency — T&E community should take advantage of (leverage) Service/Agencies activities

- **DARPA, DISA, DMA, and NSA**

  Activities that should be performed and/or funded by the appropriate agency — T&E community should take advantage of (leverage) activities performed by the agencies

- **Private Industry**

  Activities that should be leveraged by the T&E community

WORKING GROUP PROCESS AND PRODUCTS
— GROUPING OF ACTIVITIES —

The Senior Executive Panel's review identified the action organization or group that would have to implement the identified action. This slide highlights the expected activity relationships.

Within the summary of results, these organizations are identified by each action or requirement to increase the effective utilization of modeling and simulation in T&E.

Note that funding for private industry is not implied. Private industry actions are assumed to occur as a part of the development of new products for the marketplace.

WORKING GROUP PROCESS AND PRODUCTS — TYPES OF ACTIVITIES IDENTIFIED IN SENIOR EXECUTIVE PANEL REVIEW —

- Policy actions
- Management actions
- Technical actions

WORKING GROUP PROCESS AND PRODUCTS
— TYPES OF ACTIVITIES IDENTIFIED
IN SENIOR EXECUTIVE PANEL REVIEW —

Three categories of actions were identified by the senior executive panel. These were policy, management, and technical actions. Each action type is identified in the script of the summary of results below. Policy actions are identified by (P), management actions by (M), and technical actions by (T).

SUMMARY OF RESULTS

SUMMARY RESULTS: VERIFICATION, VALIDATION, AND ACCREDITATION (VV&A)

- DMSO should support the development of better VV&A tools
- T&E community needs to take leadership role in VV&A of current M&S
- Each service should establish its VV&A requirements for T&E

SUMMARY RESULTS:
VERIFICATION, VALIDATION, AND ACCREDITATION (VV&A)

DMSO needs to

(M) Support the development of automated V&V processes and support tools, and support the development of VV&A processes that stress both stand-alone and interoperable distributed simulations

The T&E community needs to

(M) Take a leadership role in the development of standards and guidelines for VV&A of models and simulations used in the T&E community and coordinate across the services
(M) Support the establishment and usage of common/shared test data for validation of common models and simulations
(M) Support the VV&A of existing models, simulations, and databases to be used as standards for T&E applications

Each service and agency should

(P) Develop/establish general requirements (responsibilities and guidelines) for VV&A of models, simulations, and associated databases prior to their use in T&E
(M) Establish a VV&A process that provides: documentation, configuration management, and shared information

SUMMARY RESULTS: STANDARD M&S AND STANDARD DATABASES

- DMSO should support development of M&S standards and require approved architectures, standards, and protocols for future joint M&S
- DMSO should demand improvement in Ada or take action to adopt another language for use in M&S
- T&E community needs to support the development of standard M&S functional area models
- Each service should implement and enforce the use of M&S standards for T&E

SUMMARY RESULTS:
STANDARD M&S AND STANDARD DATABASES

The DMSO should

- (P) Require all joint M&S be developed using DMSO-approved common, open-system architecture, with associated standards and protocols
- (P) Require that all future Joint M&S have the capability to import data from and export data to standard databases (e.g., DMA terrain databases)
- (P) Require that configuration control standards, practices and procedures be applied to M&S used in T&E
- (M) Support the development of M&S standards and the coordination of those standards across the DOD, especially with respect to architectures, interfaces, databases, definitions and documentation
- (M) Support the development of standard interfaces for selected classes of models to promote interoperability and reusability
- (M) Demand improvements in the Ada programming language to better support the M&S requirements, or take action to adopt another high-order language for use in M&S
- (M) Support appropriate waiver to Ada whenever other languages meet requirements and Ada does not
- (M) Support the development of a select few models and simulations to demonstrate the effectiveness and efficiency of those models built to meet DMSO standards

The T&E community needs to

- (M) Support the development of standard functional area models such as common threat, terrain, multi-spectral clutter, environmental, EM propagation, human behavior, and T&E specific applications

Each service and agency should

- (P) Require the use of standard data definitions/elements/formats/interfaces (as they are developed) in all future models, simulations, and databases; and encourage their use in existing models, simulations, and databases
- (P) Require the use of standard databases, as they are developed (e.g., intelligence, terrain, atmosphere and climate) in future models and simulations and encourage their use in existing models and simulations
- (P) Require that models and simulations meet established standards and metrics
- (M) Implement M&S standards and enforce those standards on models and simulations to be used in T&E, especially with respect to architectures/interfaces, databases, definitions and documentation

SUMMARY RESULTS: EDUCATION

- T&E community needs to provide educational opportunities for T&E practitioners, the acquisition work force, and decision makers on the application of M&S to T&E

SUMMARY RESULTS:
EDUCATION

The T&E community needs to

(M) Provide forums (e.g., symposia and technical meetings) for exchange of information on M&S and to "publicize" work being done in segments of the T&E community

(M) Provide M&S courses to M&S practitioners in T&E, e.g., through the Defense Test and Evaluation Professional Institute (DTEPI)

(M) Through the Defense Acquisition University, educate the acquisition work force and decision makers on the utility of M&S for T&E

SUMMARY RESULTS: INFORMATION SHARING

- DMSO should require a M&S library to support T&E across the DOD
- The T&E community needs to support information sharing on M&S support of T&E. This should include establishing M&S user groups
- The services should provide centralized coordination of the T&E M&S efforts

SUMMARY RESULTS:
INFORMATION SHARING

The DMSO should

- (P) Require that information on Joint models, simulations and databases be entered into a M&S library for sharing across the DOD
- (M) Establish a M&S information clearing house with free and easy access (library and bulletin board)

The T&E community needs to

- (M) Encourage the establishment of T&E M&S users groups, especially joint service groups, using such means as TECNET and video teleconferencing
- (M) Facilitate the communication of new technology between M&S developers and T&E practitioners

Appropriate Defense Agencies must

- (M) Facilitate communication of new technology between M&S developers (e.g., DARPA) and T&E practitioners

Services need to provide

- (M) Centralized coordination of M&S development and applications, and allow for decentralized execution of the M&S activities

Services and agencies need to

- (P) Establish a M&S focal point to coordinate all M&S efforts — particularly T&E policies and expenditures of funds
- (M) Encourage and coordinate M&S technology development at specific centers of excellence
- (T) Develop methodology to link analyses of combat effectiveness (e.g., COEAs) and T&E (including M&S for T&E, e.g., linkage between common, testable MOEs in COEAs and MOPs in testing — with feedback)

SUMMARY RESULTS: NETWORKS AND JOINTNESS

Networks

- DMSO should support the development and use of distributed, real-time processing with man- or hardware-in-the-loop capability
- Defense agencies, with requirements from the T&E community, need to provide the network capabilities to link sub-surface, surface, air, and space systems

Jointness

- DMSO is to encourage development of M&S that incorporate both vertical and horizontal integration and encourage new M&S development be compatible with network protocols
- Services are encouraged to use M&S that are capable of simulating joint operations

SUMMARY RESULTS:
NETWORKS AND JOINTNESS

NETWORKS

DMSO should support

(M) Development/use of distributed, real-time processing with man-in-the-loop and/or hardware-in-the-loop capability

The T&E community needs to

(M) Coordinate data network requirements from the T&E community with DARPA

Appropriate Defense Agencies need to provide

(T) Technology which permits high data-rate over a wide-area network (e.g., DSI) using embedded multi-level security techniques
(T) Technology which permits data linkage between sub-surface, surface, air and space systems
(T) An on-line, knowledge-based asset manager for DSI network
(T) Modifications to the DSI network to allow reconfiguration with traceability
(T) Improved data network capabilities in the areas of asset readiness check, standardized cost procedures, adjustable data rates, minimum latency and on-line context-sensitive help

JOINTNESS

DMSO needs to

(P) Encourage developers of M&S to accommodate vertical and horizontal integration (e.g., Aggregate Level Simulation Protocol)

Services and agencies need to

(P) Encourage development of models and simulations that are capable of simulating joint-service operations or that are interoperable with such simulations in order to assess the contributions of weapon systems within the joint operations environments

SUMMARY RESULTS: MULTI-LEVEL SECURITY AND PLANNING FOR THE USE OF M&S

Multi-Level security

- **The T&E community needs to work with appropriate Defense Agencies to determine security requirements for T&E M&S**

Planning for the use of M&S

- **DMSO needs to provide M&S cost effectiveness data and metrics to support use of M&S**
- **Services should require T&E personnel involvement in the development of a system M&S plan between Milestones Zero and One**

SUMMARY RESULTS:
MULTI-LEVEL SECURITY AND PLANNING FOR THE USE OF M&S

MULTI-LEVEL SECURITY

The T&E community needs to

(T) Determine requirements for multi-level security for M&S

Appropriate Defense Agencies must

(M) Support the T&E M&S community requirements to develop multi-level security capabilities to ascertain if these efforts will meet the following needs of the T&E M&S community: networks, operating systems, database management systems and high-speed encryption/decryption

PLANNING FOR THE USE OF M&S

DMSO needs to

(M) Develop data and metrics on the cost effectiveness and other benefits of M&S in T&E

Each service and agency should

(P) Require the establishment of a M&S plan between Milestone Zero and Milestone One and require T&E personnel be involved in preparation of the plan; and review and update the plan for use of M & S at each Milestone

(M) Give M&S appropriate consideration and priority in the resource allocation process

SUMMARY RESULTS: M&S DEVELOPMENT

M&S Development

- **DMSO is to support use of M&S in T&E by supporting advances in software**
- **T&E should encourage the development of models and simulations that are capable of real-time T&E applications**

SUMMARY RESULTS:
DEVELOPMENT

M&S DEVELOPMENT

DMSO needs to

(M) Support the development of software tools that provide the following capabilities:
Visual programming
Visualization/Imaging Virtual Reality
Data Compression
Dynamic User-defined Environment
Standard SW Development Methodology
Automated Documentation

(M) Support the development of software that supports distributed execution across networks of massively-parallel systems

T&E needs to

(P) Encourage the development of models and simulations that are capable of real-time T&E applications

SUMMARY RESULTS: INDUSTRY DEVELOPMENTS

Industry Developments

- **Improved Computer Hardware**
- **Graphics Output Capability**

SUMMARY RESULTS:
INDUSTRY DEVELOPMENTS

INDUSTRY DEVELOPMENT

The T&E community should be cognizant of and ready to leverage activities being performed by private industry to develop new and improved products, particularly in the areas of

- Computer hardware, where faster computers and/or more data storage capacity can make models and simulations run in less time

- Graphics output capability, where graphical and visual output can be used in models and simulations in real time during the running of the model

SUMMARY RESULTS: DEVELOPERS HANDBOOK

Developers Handbook

- DMSO is to support use of M&S in T&E by the development of a M&S developers handbook

SUMMARY RESULTS:
DEVELOPERS HANDBOOK

DEVELOPERS HANDBOOK

DMSO needs to

(M) Support the development and distribution of a M&S developers handbook ,in coordination with the Defense Systems Management College (DSMC), which covers the following subjects :

- portability
- interoperability
- credibility
- usability
- flexibility/reconfigurability
- reusability
- internetting
- security
- linking
- fidelity
- variable fidelity/resolution/scale/scope
- VV&A
- robust capability
    - — multi-spectral
    - — soft kill/hard kill
- object-oriented and open-systems architecture
- real-time operations
- man-in-the-loop
- hardware-in-the-loop
- distributability
- accessibility
- data interface standards, including:
    - — data definitions
    - — format
    - — joint data/object dictionary
    - — capability for on-line cases
    - — capability for network stand-alone

SUMMARY RESULTS:
TOOLS & HANDBOOK
(CONCLUDED)

DEVELOPER TOOLS AND HANDBOOK (concluded)

DMSO needs to (concluded)

(M) Support the development and distribution of a M&S developers handbook (in coordination with DSMC) which covers the following subjects (concluded):

- database capabilities, including:
  - — standardized data definitions and formats
  - — common data on-line dictionary
  - — intelligent access procedures
  - — validation audit trail
  - — configuration management, maintenance and distribution
  - — multi-level security
  - — accessibility

- writing development contracts so that the government has access to models, simulations, data bases and associated documentation (developed under contract) at reasonable cost

- promoting early involvement of T&E M&S managers, developers and users in the acquisition process to make T&E M&S requirements known for planning purposes

APPENDIX A

M&S REQUIREMENTS WITHIN THE TEST AND EVALUATION COMMUNITY

M&S Requirements within the Test and Evaluation Community

Introduction

T&E M&S requirements are grouped (a) by organization responsible for fulfilling the requirements, (b) by priority and (c) by area -- policy, management, technical

- Fulfillment of these requirements is not necessarily the sole responsibility of the T&E community; other major players also have a role:
  - Defense Modeling and Simulation Office (DMSO)
    Many activities should be performed by and/or funded by DMSO; T&E community should take advantage of (leverage) DMSO actions
  - Director, Test and Evaluation (DT&E) -- as Representative for T&E Community
    Some activities should be supported by DT&E and performed by the T&E community separately or through the DMSO process
  - Services/Agencies
    Many activities should be performed by and/or funded by each service and agency for internal use

Introduction (Cont'd)

- DARPA, DISA, DMA and NSA
  Some activities should be performed by and/or funded by one of the defense agencies for use external to the agency -- T&E community should take advantage of (leverage) these activities

- Commercial Sector of Private Industry
  Some activities will likely be performed by private industry to develop new and improved products, without any government funding

- M&S Requirements for T&E Community were prioritized

  Priority 1 -- activities that should be started/funded now

  Priority 2 -- activities that should be accomplished/funded in the future

- The requirements were also subdivided into the three types of action needed: policy, management and technical

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Subject: Transmittal of Report Documentation Page and DMSO Test and Evaluation Functional Working Group Workshop Proceedings

The attached document is submitted for inclusion in the DTIC collection of scientific and technical publications. Point of contact for this document is Richard O. Nugent of this organization who can be reached at (703) 883-6320.

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13. ABSTRACT *(Maximum 200 words)*

During 1992, a series of workshops was conducted in support of the Defense Modeling and Simulation Office (DMSO) to determine the modeling and simulation (M&S) needs of the defense M&S community. This community is partitioned into five major areas: Education, Training and Military Operations (ETMO), Research and Development (R&D), Test and Evaluation (T&E), Production and Logistics (P&L), and Analysis. Each of these areas has a Functional Working Group (FWG) representing its interests to the DMSO and other interested parties. Workshops were conducted to assist the FWGs in determining the "requirements pull" to be considered in the development of the DMSO Master Plan.

This report presents the results of the Test and Evaluation Workshop in developing Modeling and Simulation needs for the T&E community. The executive summary provides an overview of the background, objectives, and organization of the workshop and summarizes the workshop results. The body presents the workshop background and objectives, describes the working groups, process and products, and provides an expanded summarization of the workshop results.

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8. PERFORMING ORGANIZATION REPORT NUMBER

N/A

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

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10. SPONSORING/MONITORING AGENCY REPORT NUMBER

N/A

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12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

During 1992, a series of workshops was conducted in support of the Defense Modeling and Simulation Office (DMSO) to determine the modeling and simulation (M&S) needs of the defense M&S community. This community is partitioned into five major areas: Education, Training and Military Operations (ETMO), Research and Development (R&D), Test and Evaluation (T&E), Production and Logistics (P&L), and Analysis. Each of these areas has a Functional Working Group (FWG) representing its interests to the DMSO and other interested parties. Workshops were conducted to assist the FWGs in determining the "requirements pull" to be considered in the development of the DMSO Master Plan.

This report presents the results of the Test and Evaluation Workshop in developing Modeling and Simulation needs for the T&E community. The executive summary provides an overview of the background, objectives, and organization of the workshop and summarizes the workshop results. The body presents the workshop background and objectives, describes the working groups, process and products, and provides an expanded summarization of the workshop results.

14. SUBJECT TERMS	15. NUMBER OF PAGES
modeling, simulation, test, evaluation, workshop, needs	216 pages
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DMSO

PRIORITY 1

POLICY

- Joint models, simulations and data bases shall be entered into a M&S library so they can be shared across the DOD
- Require all joint models and simulations be developed using DMSO-approved common, open-system architectures, with associated standards and protocols
- Require that future joint models and simulations have the capability to import data from and export data to standard databases (e.g., DMA terrain database)
- Require that configuration control standards, practices and procedures be applied to models and simulations

DMSO

PRIORITY 1

POLICY (CONT'D)

- Encourage developers of models and simulations to accommodate vertical and horizontal integration (e.g., Aggregate Level Simulation Protocol)

MANAGEMENT

- Establish a M&S information clearing house with free and easy access (library and bulletin board)
- Support development of M&S standards and coordination of those standards across the DOD, especially with respect to architectures, interfaces, databases, definitions and documentation
- Support the development and use of distributed, real-time processing with man-in-the-loop and/or hardware-in-the-loop capability

DMSO

PRIORITY 1

MANAGEMENT (CONT'D)

- Support development and distribution of a M&S developers handbook (in coordination with DSMC) which covers the following subjects:

  - portability
  - interoperability
  - credibility
  - useability
  - flexibility/reconfigurability
  - reusability
  - internetting
  - security
  - linking
  - fidelity
  - variable fidelity/resolution/scale/scope
  - VV&A

DMSO

PRIORITY 1

MANAGEMENT (CONT'D)

- Handbook (Cont'd)
  - robust capability
    - -- multi-spectral
    - -- soft kill/hard kill
  - object-oriented and open-systems architecture
  - real-time operations
  - man-in-the-loop
  - hardware-in-the-loop
  - distributability
  - accessibility
  - data interface standards, including:
    - -- data definitions
    - -- format
    - -- joint data/object dictionary

DMSO

PRIORITY 1

MANAGEMENT (CONT'D)

- Handbook (Cont'd)

  - -- capability for on-line cases
  - -- capability for network stand-alone
  - databases capabilities, including:
    - -- standardized data definitions and formats
    - -- common data on-line dictionary
    - -- intelligent access procedures
    - -- validation audit trail
    - -- configuration management, maintenance and distribution
    - -- multi-level security
    - -- accessibility
  - Writing development contracts so that the government has access to models, simulations, data bases and associated documentation (developed under the contract) at reasonable cost

DMSO

PRIORITY 1

MANAGEMENT (CONT'D)

- Handbook (Cont'd)
  - Promoting early involvement of T&E M&S managers, developers and users in the acquisition process to make T&E M&S requirements known for planning purposes
- Support the development of automated V&V processes and support tools, and the development of VV&A processes that stress both stand-alone and interoperable distributed simulations
- Support the development of standard interfaces for selected classes of models to promote interoperability and reusability

DMSO

PRIORITY 1

MANAGEMENT (CONT'D)

- Demand improvements in the Ada language to better support M&S requirements, or take action to adopt another high order language for use in models and simulations

- Provide support for appropriate waiver to Ada whenever other languages meet requirements and Ada does not.

- Support development of software tools providing the following capabilities:

  - visual programming
  - visualization/imaging virtual reality
  - data compression
  - dynamic user-defined environment
  - standard SW development methodology
  - automated documentation

DMSO

PRIORITY 1

MANAGEMENT (CONT'D)

- Support development of software that supports distributed execution across networks of massively-parallel systems
- Support the development of a select few models and simulations to demonstrate the effectiveness and efficiency of those models built to meet DMSO standards
- Develop data and metrics on the cost effectiveness and other benefits of M&S

TECHNICAL

- NONE

DMSO

PRIORITY 2

POLICY

- NONE

MANAGEMENT

- NONE

TECHNICAL

- NONE

DT&E as Representative for T&E Community

PRIORITY 1

POLICY

- NONE

MANAGEMENT

- Take a leadership role in the development of standards and guidelines for VV&A of models and simulations used in T&E -- coordinate across the services
- Support establishment and usage of common/shared test data for validation of common models and simulations
- Support the VV&A of existing models, simulations and databases to be used as standards for T&E applications

DT&E as Representative for T&E Community

PRIORITY 1

MANAGEMENT (CONT'D)

- Through the DMSO proposal process, support the VV&A of existing models, simulations and databases and development of new standard models and databases for the following functional areas/databases used throughout the T&E community (thus promoting software reusability and agency collaboration and eliminating duplication of effort), including, but not limited to:
  - common threat
  - terrain
  - environmental (eg., weather, obscurance, multi-spectral clutter)
  - EM propagation
  - human behavior
  - T&E specific applications

- Encourage the establishment of T&E M&S user groups, especially joint service groups, using such means as TECNET and video teleconferencing

DT&E as Representative for T&E Community

PRIORITY 1

MANAGEMENT (CONT'D)

- Coordinate data network requirements with DARPA for the T&E community

TECHNICAL

- NONE

DT&E as Representative for T&E Community

PRIORITY 2

POLICY

- Encourage the development of models and simulations that are capable of real-time T&E applications

MANAGEMENT

- Education:
  - Provide forums (e.g., symposia and technical meetings) for exchange of information on M&S and to "publicize" work being done in segments of the T&E community
  - Provide M&S courses for M&S practitioners in T&E, e.g. through DTEPI (Defense Test and Evaluation Professional Institute)

DT&E as Representative for T&E Community

PRIORITY 2

MANAGEMENT (CONT'D)

- Education (CONT'D):
  - Through the Defense Acquisition University educate the acquisition workforce and decision makers on the utility of using M&S for T&E
- Facilitate communication of new technology between M&S developers (e.g., DARPA) and T&E practitioners

TECHNICAL

- Determine multi-level security requirements for M&S and make those requirements known to DARPA/DISA

Services and Agencies

PRIORITY 1

POLICY

- Each service and agency should establish a central M&S focal point to coordinate all M&S efforts -- particularly T&E policies and expenditures of funds

- Each service and agency should require the establishment of a M&S plan between Milestone 0 and Milestone 1 and require T&E personnel be involved in preparation of the plan. Review and update the plan for use of Modeling & Simulation at each Milestone.

- Each service and agency should develop/establish general requirements (responsibilities and guidelines) for verification, validation and accreditation (VV&A) of models, simulations and associated data bases prior to their use in test and evaluation

Services and Agencies

PRIORITY 1

POLICY (CONT'D)

- Each service and agency should require the use of standard data definitions/elements/formats/interfaces (as they are developed) in all future models, simulations and databases. Encourage their use in existing M&S and databases.

- Each service and agency should require the use of standard databases, as they are developed, (e.g., intel, terrain, atmosphere and climate) in future models and simulations. Encourage their use in existing M&S.

- Each service and agency should require that models and simulations software meet established standards and metrics.

Services and Agencies

PRIORITY 1

MANAGEMENT

- Each service and agency should establish a VV&A process that provides:
  - Documentation
  - Configuration management
  - Shared information
- Give M&S appropriate consideration and priority in the resource allocation process
- Implement M&S standards and enforce those standards on models and simulations to be used in T&E, especially with respect to architectures/interfaces, databases, definitions and documentation.

Services and Agencies

PRIORITY 1

MANAGEMENT (CONT'D)

- Provide centralized coordination of M&S development and applications and allow for decentralized execution of M&S activities
- Encourage and coordinate M&S technology development at specific centers of excellence

TECHNICAL

- Develop methodology to link analyses of combat effectiveness (e.g., COEAs) and T&E (including M&S for T&E). For example, linkage between common testable MOEs in COEAs and MOPs in testing -- with feedback.

Services and Agencies

PRIORITY 2

POLICY

- Encourage development of models and simulations that are capable of simulating joint-service operations or that are interoperable with such simulations in order to assess the contributions of weapon systems within the joint operations environments.

MANAGEMENT

- NONE

TECHNICAL

- NONE

DARPA, DISA, DMA and NSA

PRIORITY 1

POLICY

- NONE

MANAGEMENT

- Support T&E M&S community requirements to develop multi-level security capability to ascertain if these efforts will meet the following needs of the T&E M&S community

  - Networks
  - Operating systems
  - Database Management Systems
  - High speed encryption/decryption

- Facilitate communication of new technology between M&S developers (e.g., DARPA) and T&E practitioners

DARPA, DISA, DMA and NSA

PRIORITY 1

TECHNICAL

- Provide technology which permits high data-rate over a network (e.g., DSI) using embedded multi-level security techniques

DARPA, DISA, DMA and NSA

PRIORITY 2

POLICY

- NONE

MANAGEMENT

- NONE

TECHNICAL

- Provide technology which permits data linkage between sub-surface, surface, air and space systems

DARPA, DISA, DMA and NSA

PRIORITY 2

TECHNICAL (CONT'D)

- Provide an on-line knowledge-based asset manager for DSI network
- Modify the DSI network to be reconfigurable with traceability
- Establish improved data network capabilities in the areas of:
  - asset readiness check
  - standardized cost procedures
  - adjustable data rates
  - minimum latency
  - on-line context-sensitive help

Commercial Sector of Private Industry

LEVERAGE INDUSTRY DEVELOPMENTS

- Improved Computer Hardware -- faster computers and/or more data storage capacity

  Make models and simulations run in less time through the use of faster computers or parallel processing hardware

- Graphics Output Capability

  Utilize graphical and visual output capabilities in models and simulations, preferably in real time while the model or simulation is running

APPENDIX B

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T&E Requirements Conference

PARTICIPANTS LIST

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APPENDIX C

VISION

ARMY WORKING GROUP

VISION

OPPORTUNITIES/NEEDS

"The Army wants to be able to ..."

- **Test & evaluate non-traditional threats (e.g., SO/LIC) and associated spectra of conflict**
- **Share T&E models and data among the DoD activities and among the Government agencies (e.g., NASA, Commerce, ITS)**
- **Use M&S to increase support of T&E planning, conduct, data reduction, real-time assessment, analysis, reporting and distribution**

ARMY WORKING GROUP

OPPORTUNITIES/NEEDS (Concluded)

- Create a joint M&S capability which directly relates test results to combat effectiveness for all weapon systems (e.g., C3I, Intel Fusion, Human Factors)
- Build life-cycle simulations, early on, in support of T&E which also support all other phases of acquisition, training, and deployment
- Create M&S to support T&E of large-scale composite systems (e.g., GPALS)

ARMY WORKING GROUP

CAPABILITIES

"The capabilities required by M&S to meet the opportunities are:"

- Management with a vision of the value of M&S in T&E
- Capability to perform Real-Time Data Collection, Reduction, Visualization, and Distribution from simulation, testing, and live exercises
- Standardized databases, support models, and software methodologies to improve the efficiency and effectiveness of M&S in support of T&E

ARMY WORKING GROUP

CAPABILITIES (Concluded)

- Network capabilities to transfer & process large volumes of data from netted systems testing (e.g., C3I, Space)
- VV&A Procedures; Documentation
- Training in all disciplines related to M&S

ARMY WORKING GROUP

INFRASTRUCTURE VISION

"The characteristics of an infrastructure to enhance integration of the M&S Community in the T&E Community are:"

- Communications/Distributed Data Systems / Desktop Systems to share information (e.g., status, reviews) - FREE
- Training (e.g., via model user groups)
- Centers of Excellence/Service Proponency Office

ARMY WORKING GROUP

INFRASTRUCTURE VISION (Concluded)

- Incentives for sharing
- Mechanism for early involvement
- Streamline ADPE procurement process

ARMY WORKING GROUP

ARCHITECTURE, STANDARDS AND PROTOCOL VISION

Characteristics to support the interoperability of M&S across the T&E Community are:"

- Open Systems Architecture
- JMASS-like Architecture
- Standardized/Coordinated Model Design (e.g., CASE Tools)
- Standards must be responsive to user needs (e.g., ADA)

ARMY WORKING GROUP

ARCHITECTURE, STANDARDS AND PROTOCOL VISION (Concluded)

- 'Horizontal' and 'Vertical' interoperability / interfaces
- Standard nomenclature for objects

APPENDIX D

VISION

NAVY WORKING GROUP

VISION

FUTURE OPPORTUNITIES

- Reduce Cost of T&E
  - Consolidate resources
  - Affordable interoperability
- Testing the Untestable
  - Expand testing envelope
  - Live fire testing
- Earlier Involvement of Testers & Users
  - Earlier Op assessments
  - Evaluate design early

NAVY WORKING GROUP

FUTURE OPPORTUNITIES (Continued)

- Early dev of deployment tactics
- Support source selection process

- Increased System Characterization Robustness
  - Augment real test data
  - Expand testing envelope
  - Component eval in broader warfighting context
  - Sim as rigorous extension of eng dev
- Improved Test Design
  - Conserve test assets

NAVY WORKING GROUP

FUTURE OPPORTUNITIES (Continued)

- Improved System Design
  - SW IV&V
- Increased Efficiency of Life-Cycle

Additional Ungrouped Opportunities

- Replay & post-op trouble shooting
- Characterize systems through modeling and validate models through testing
- Overcome T&E, site limitations

NAVY WORKING GROUP

FUTURE OPPORTUNITIES (Concluded)

Additional Ungrouped Opportunities

- Reduce duplication of T&E capabilities
- Improve inter/intra service co-op
- Audit trail from design-eval tools
- Seamless DT-OT transition
- Fix M&S dev responsibilities

NAVY WORKING GROUP

CAPABILITIES VISION

- Cheaper and More Capable HW
- New/High Fidelity Modeling Capabilities
  - High environmental fidelity
  - Varying fidelity
  - Non-traditional
  - Multi-spectral
- Near Field Target Signature Effects
- Real-Time Man/HW in the Loop Case
- CASE
  - CM & doc Control

NAVY WORKING GROUP

CAPABILITIES VISION (Concluded)

- Model Interoperability Techniques
  - Ease of training & use
  - Tie-in to related/support systems
  - Universal bridge
  - Intel compatibility checker
- Multi-level security (high data rate)
- Intelligent data bases
- Optimal test planning

NAVY WORKING GROUP

INFRASTRUCTURE VISION

- Single Point of Contact for Each Service
- Standardized Cost Estimating/Accounting
- Sim User Organization
- Standardized Operational Procedures
- Readiness Checking/Reporting
- Index of Models w/ Descriptions
- Central Conflict Resolution

NAVY WORKING GROUP

INFRASTRUCTURE VISION (Concluded)

- Easily Accessible from Model Catalog
- Rapid, Responsible Accreditation Process
- Interference Effects of Models
- Management & Control of Models
- Sponsor Org/Funding Program Element
- Test Data Repository
- User Defined Test Data Packages
- Brief & Debrief Capabilities

NAVY WORKING GROUP

ARCHITECTURE, STANDARDS AND PROTOCOL VISION

- Data Rates
- Shared Data Base
- Data Latency
- Encryption
- Selectable Player View
- Sub-Surface Connectivity
- Bandwidth/Compatibility

NAVY WORKING GROUP

ARCHITECTURE, STANDARDS AND PROTOCOL VISION

- Data Links
- Protocols
- Manage/Schedule/Control Access/Audit
- Portable/Independent Nodes
- Common/Flexible Scenarios
- Dynamic Command Structure
- On-Line Help
- Open Distributed Arch/Common Op Env

APPENDIX E

VISION

AIR FORCE WORKING GROUP

VISION

VISION

"A M&S capability so complete and comprehensive that when a live test is performed, it is merely a demonstration of the system's anticipated performance"

AIR FORCE WORKING GROUP

OPPORTUNITIES

- Mission Level Analysis
- Requirement Definition
- Test Planning
- Test Execution

AIR FORCE WORKING GROUP

FUTURE OPPORTUNITIES

- Enhance test scenarios
- Supplement field testing
- Improve test effectiveness & efficiency
- Reduce cost schedule & risk
- Enhance systems performance (identify deficiencies)

AIR FORCE WORKING GROUP

FUTURE OPPORTUNITIES (Continued)

- Perform early integration testing
- Evaluate high-level systems interfaces
- Predict/extrapolate test results
- Understand test anomalies
- Establish analysis hierarchy
- Simulate when can't test (space/security/ safety)

AIR FORCE WORKING GROUP

FUTURE OPPORTUNITIES (Concluded)

- Establish logistics supportability
- Utilize virtual prototyping
- Link all test resources

AIR FORCE WORKING GROUP

CAPABILITIES VISION

M&S will need to provide:

- **Portability**
- **Interoperability**
- **Credibility**
- **Realistic**
- **Distributed test capability**
- **Very high speed linking**

AIR FORCE WORKING GROUP

CAPABILITIES VISION (Concluded)

- **Common architecture**
- **Real-time operation**
- **Variable resolution**
- **Ease of use**
- **Scaleable**

AIR FORCE WORKING GROUP

INFRASTRUCTURE VISION

Characteristics

- Central AF focal point
- Decentralized execution
- Training
- Disciplined test process
- Model repository/clearing facility
- High performance communications & computing
- Funding

AIR FORCE WORKING GROUP

INFRASTRUCTURE VISION (Concluded)

Categories of Shared Information

- Architecture
- Models
- Databases

AIR FORCE WORKING GROUP

ARCHITECTURE, STANDARDS AND PROTOCOL VISION

- Information content
  - Joint data dictionary
- Information format
- Physical connections
  - High speed network
  - Minimum latency
  - DIS interface

AIR FORCE WORKING GROUP

ARCHITECTURE, STANDARDS AND PROTOCOL VISION (Concluded)

- Open systems
- Real-time/non real-time compatibility

APPENDIX F

VISION

DEFENSE AGENCIES WORKING GROUP

VISION

FUTURE OPPORTUNITIES

- Incorporate Technology
- M&S Framework
- Supplement T&E/Pre-Test Design
- Reduce Duplication
- Common Data Sources
- Traceability/Criticality Analysis

DEFENSE WORKING GROUP

FUTURE OPPORTUNITIES (Concluded)

Modeling & Simulation of Requirements

- Proof of Concept
- Test Design (DT&E, OT&E)
- Identify T&E Deficiencies
- Lower Costs
- Better Efficiency

DEFENSE WORKING GROUP

CAPABILITIES VISION

- Databases
  - Data dictionary
  - Data definitions
- Credible Models – Interoperable
- Internet – Accessibility/Sources
- Interaction between providers and users or models
- Real-Time Processing to Permit Man-in-the-Loop

DEFENSE WORKING GROUP

CAPABILITIES VISION (Continued)

- Rapid Configuration/Varying Resolution
- Object Oriented Code – Reusable
- Visual Programming/Open Systems

DEFENSE WORKING GROUP

CAPABILITIES VISION (Concluded)

- Visualization
  - graphic depictions (red carpet)
  - holographic displays
- Scalable Results
- Scaled Prototypes
- Compute power to permit M&S without aggregation

DEFENSE WORKING GROUP

INFRASTRUCTURE VISION

- Software Research Facilities/Repositories
- Big Integrated Net
- Distributed Databases
- Multi-Security Levels
- Organization for Standards Dissemination

DEFENSE WORKING GROUP

INFRASTRUCTURE VISION (Concluded)

- Training
  - Properly trained people
  - Proper tool
  - Grade structures/skill requirements
  - Career path

DEFENSE WORKING GROUP

ARCHITECTURE, STANDARDS AND PROTOCOL VISION

- Classes of Architecture (terrain, weather, system, doctrine, 1←→1, 1←→N, N←→N...)
- Standard Data Definitions
- Standardized Net Interfaces
- Alternate Technology for Data Transmission
- Greater Compute Power

APPENDIX G

INTEGRATED VISION AND NEEDS

POLICY WORKING GROUP

INTEGRATED VISION AND NEEDS

GENERAL OVERVIEW

Define Policy Required for DoD Vision for M/S Supporting T&E

- **Opportunities**
- **Capabilities**
- **Architecture**
- **Infrastructure**

POLICY WORKING GROUP

INTEGRATED OPPORTUNITIES VISION

- Share models and data across DoD
- M&S should be used to support the T&E process throughout the system life cycle
  - V&V design requirements
  - development to deployment
  - operational assessments
- M&S shall relate test results to combat effectiveness

POLICY WORKING GROUP

INTEGRATED OPPORTUNITIES VISION (Conc'd)

- Develop a T&E Master Plan to use M&S through all system milestones
- M&S should be used when live tests cannot be conducted
- Establish central M&S authority to which all T&E M&S activities must report
- VV&A Policy for M&S (credibility, suitability...)

POLICY WORKING GROUP

INTEGRATED CAPABILITIES VISION

- M&S will be designed/modified with the following in mind: portability, interoperability, creditability, usability, flexibility, reusability, internetting and security, and linking.
- M&S will consist of a standardized documented version which will remain intact; changes to the standard will occur to other versions
- Encourage distributed, real-time processing with Man-in-the-loop/HW in the loop capability
- Capable of playing roles in joint-service scenarios providing essential degree of realism

POLICY WORKING GROUP

INTEGRATED CAPABILITIES VISION (Conc'd)

- Establish high volume networks for transfer of multi-level classification of test data
- Perform real-time data collection, reduction, visualization, and distribution
- Establish "library" of validated M&S modules (at DoD or Service levels)
- Establish "Lessons-Learned" Library

POLICY WORKING GROUP

INTEGRATED ARCHITECTURE VISION

- M&S should be developed using a common open systems architecture using associated standards and protocols
- M&S Software should meet established standards and metrics (i.e., MIL-STD-2167A, Army step process,...)
- Require the use of common databases (i.e., intel, terrain, atmosphere, climate,...)
- All M&S architectures should have the capability to import and export standard databases produced by DoD OPRs

POLICY WORKING GROUP

INTEGRATED ARCHITECTURE VISION (Conc'd)

- The contractor should provide non-proprietor deliverable software package
- Producers of common databases will comply with standard database elements definitions
- M&S will allow vertical and horizontal integration (i.e., ALSP)
- Architecture, standards, and protocol must provide for variable fidelity (as dictated by user needs)

POLICY WORKING GROUP

ARCHITECTURE NEEDS

- Standardized data definitions
- Standard database elements
- Internet should be capable of providing data links for sub-surface/surface/air

POLICY WORKING GROUP

INTEGRATED INFRASTRUCTURE VISION

- All M&S used in support of T&E will be accredited by the user
- DoD components shall establish V, V&A policy, procedures, and responsibilities
- M&S users/developers shall use valid data
- M&S developers will coordinate data requirements with DoD OPR prior to expenditure of funds
- Training: A M&S career track will be established to include M&S course work

APPENDIX H

INTEGRATED VISION AND NEEDS

MANAGEMENT WORKING GROUP

INTEGRATED VISION AND NEEDS

From a Management Perspective, Modeling & Simulation in Support of Test & Evaluation Should:

- Reduce Costs
- Reduce Risks
- Increase Efficiency
- Reduce Schedules
- Improve T&E Process Credibility

To Attain These Goals, the Following Must Be Done:

- **Increase Use of M&S in T&E**
- **Share Models & Data**
- **Standardize VV&A Process**
- **Provide Infrastructures for Information & Interoperability**

Increase Use of M&S in T&E

- **Promote Early Involvement**
- **Provide Centralized Coordination and Allow for Decentralized Execution**
- **Establish Service Proponency**
- **Expand to all Phases of T&E**
- **Provide Resources**

MANAGEMENT WORKING GROUP

Share Models and Data

- Standardize:
  - architecture
  - data bases
  - definitions
  - documentation
- Educate
  - publicize
  - train
- Distribute
- Resource

MANAGEMENT WORKING GROUP

Provide Infrastructure for Information & Interoperability

- Develop & Maintain Models/Data Bases
- Improve Network
- Establish Multi-level Security Capability
- Develop & Use Multi-service Expertise

MANAGEMENT WORKING GROUP

Standardize VV&A Process

APPENDIX I

INTEGRATED VISION AND NEEDS

TECHNICAL WORKING GROUP 1

INTEGRATED VISION AND NEEDS

TECHNICAL WORKING GROUP #1

VISION

Use M&S technology for affordable, timely, and cost effective T&E as part of the total weapon system life cycle through reusable components interoperating in an open system architecture.

TECHNICAL WORKING GROUP #1

INTEGRATED OPPORTUNITIES VISION

- Use simulations to do things that can't be done with field tests
  - site limitations
  - safety/security issues
  - large scale composite systems
  - environmental concerns
  - expand test envelope
  - live fire testing
  - interoperability

TECHNICAL WORKING GROUP #1

INTEGRATED OPPORTUNITIES VISION

- Share service assets
  - common data sources
  - joint scenarios
  - reduce duplication
  - models & data

TECHNICAL WORKING GROUP #1

INTEGRATED OPPORTUNITIES VISION

- Improve acquisition test planning
  - requirements (systems & test) definition
  - identify T&E deficiencies
  - traceability/criticality analysis
  - audit trail from design-eval tools
  - test effectiveness & efficiency

TECHNICAL WORKING GROUP #1

INTEGRATED OPPORTUNITIES VISION

- Increase systems characterization robustness
  - augment test results
  - conserve test assets
  - eval in broader warfighting context (including logistics)
  - scaleability/scope

TECHNICAL WORKING GROUP #1

INTEGRATED OPPORTUNITIES VISION

- Enable virtual prototyping
  - proof of concept
  - technology incorporation
  - support early integration testing
  - early and continuous involvement in life cycle
  - early involvement of tactics development
  - support source selection process
  - transition to training
  - SW IV & V
  - seamless DT & OT
  - high-level systems interfaces

TECHNICAL WORKING GROUP #1

INTEGRATED OPPORTUNITIES VISION

- Support test execution
  - data reduction, analysis
  - reporting and distribution
  - understand test anomalies
  - replay/post-op trouble shooting
  - link test resources

TECHNICAL WORKING GROUP #1

INTEGRATED CAPABILITIES VISION

- **Databases**
  - **standardization**
  - **common data on-line dictionary**
  - **intelligent**
  - **common threat, environment, terrain, etc.**
  - **validation**
  - **CM, maintenance and distribution**
  - **multi-level security**
  - **accessibility**
  - **support multi-level fidelity**

TECHNICAL WORKING GROUP #1

INTEGRATED CAPABILITIES VISION

- **Network**
  - **very high speed**
  - **wide band**
  - **multi-level security**
  - **real-time**
  - **accessibility**

TECHNICAL WORKING GROUP #1

INTEGRATED CAPABILITIES VISION

- Models
  - varying fidelity
  - scale/scope
  - very high fidelity
  - interoperability (between models)
  - robust capability
    - multi-spectral
    - soft kill/hard kill
  - ease of use
  - portable

TECHNICAL WORKING GROUP #1

INTEGRATED CAPABILITIES VISION

- Models (continued)
  - object-oriented and open systems architecture
  - real-time operations
  - man-in-the-loop
  - hardware-in-the-loop

TECHNICAL WORKING GROUP #1

INTEGRATED CAPABILITIES VISION

- Simulation technology
  - CASE tools
  - visual programming
  - open systems
  - low-cost/distributed/massively-parallel systems
  - visualization/imaging virtual reality
  - multi-spectral
  - methodology development
  - intelligent compatibility checker
  - hypermedia
  - data compression

TECHNICAL WORKING GROUP #1

INTEGRATED CAPABILITIES VISION

- VV&A
  - standardized documentation
  - formal CM
  - on all M&S components
  - central service focal point
  - automated VV&A

TECHNICAL WORKING GROUP #1

INTEGRATED CAPABILITIES VISION

- **Expertise**
  - **decision makers with realistic expectations**
  - **training in all M&S disciplines**
  - **multi-disciplined teams**

TECHNICAL WORKING GROUP #1

INTEGRATED ARCHITECTURE VISION

Characteristics of architecture to support interoperability across T&E community and be responsive to user needs

TECHNICAL WORKING GROUP #1

INTEGRATED ARCHITECTURE VISION

- Open systems
  - attuned to industry changes
  - ISO
- data interface standards
  - data definition
  - format
  - on-line test cases
  - network and stand-alone
  - joint data/object dictionary

TECHNICAL WORKING GROUP #1

INTEGRATED ARCHITECTURE VISION

- Supports standard SW development methodology with SW support environment including automated documentation
- Compatible classes of architecture (terrain, weather, system, etc)
- Horizontal and vertical interoperability/ interfaces
- Supports distributed model design across networks or massively-parallel systems

TECHNICAL WORKING GROUP #1

INTEGRATED ARCHITECTURE VISION

- Physical connections
  - DIS interface
  - tunable data rates
  - minimum latency
- Embedded multi-level security
- On-line context-sensitive help
- On-line knowledge-based asset manager

TECHNICAL WORKING GROUP #1

INTEGRATED ARCHITECTURE VISION

- Graphical user interface
- Service unique interfaces
- Dynamic user-defined environment
  - player view
  - object configuration
  - output display
  - test control
  - briefing/debriefing capability

TECHNICAL WORKING GROUP #1

INTEGRATED INFRASTRUCTURE VISION

- Establish model & data management
  - repository/clearing house (free and easy access)
  - standards development & dissemination
  - simulation user organization
  - formal CM
- Service proponency office
  - centralized management
  - decentralized execution

TECHNICAL WORKING GROUP #1

INTEGRATED INFRASTRUCTURE VISION

- Centers of excellence
  - technical focal point for model CM
  - research into advanced and efficient algorithm development ... simulation technology
- Formal VV&A process
  - includes IV & V
  - service accreditation agent

TECHNICAL WORKING GROUP #1

INTEGRATED INFRASTRUCTURE VISION

- Network
  - net management
  - high performance
  - asset readiness check
  - standardized cost estimated
- Training
  - properly trained people
  - provide proper tools
  - grade structures/skill requirements
  - career path

TECHNICAL WORKING GROUP #1

INTEGRATED INFRASTRUCTURE VISION

- Funding/procurement
  - sponsoring organization
  - funding program element (6.2,6.3,...)
  - streamlined ADPE procurement
- Disciplined scientific test process
  - early involvement of warfighter and T&E community with test process

APPENDIX J

INTEGRATED VISION AND NEEDS

TECHNICAL WORKING GROUP 2

INTEGRATED VISION AND NEEDS

INTEGRATED OPPORTUNITIES VISION

- Share T&E models and data among the DoD activities and among the Government agencies (e.g., NASA, Commerce, ITS) to minimize duplication of effort, reduce costs, and promote inter-agency cooperation
- Promote interoperability through common architecture, standards, communications protocols, physical linking of T&E facilities and common/shared databases

TECHNICAL WORKING GROUP #2

INTEGRATED OPPORTUNITIES VISION (Continued)

- Use models and simulations to test and evaluate
  - Non traditional threats and missions
  - Untestable (safety,security,cost, environment)
  - Systems of systems
  - Multi-force/multi-mission

TECHNICAL WORKING GROUP #2

OVERALL VISION STATEMENT

"A M&S capability so complete and comprehensive that when a live test is performed, it is merely a demonstration of the system's anticipated performance"

TECHNICAL WORKING GROUP #2

INTEGRATED OPPORTUNITIES VISION (Concluded)

- Develop simulator/simulation representing the system in parallel with system development and maximize reuse of simulation model/modules
- Use M&S throughout the system life-cycle to increase support of T&E planning, conduct, data reduction, real-time assessment, analysis, reporting, distribution and training
- M&S development in the future will become more efficient and creditable

TECHNICAL WORKING GROUP #2

INTEGRATED CAPABILITIES VISION

- Models and Simulations shall operate in multi-level secure environments
- Modeling and Simulation shall be supported by common/shared/intelligent databases

TECHNICAL WORKING GROUP #2
INTEGRATED CAPABILITIES
VISION (Continued)

- Models and Simulation architectures shall support standards for interoperability and portability
- Models and Simulation hardware will provide the power/speed/memory to support real-time execution, visualization, distribution from simulation, testing and live fire

TECHNICAL WORKING GROUP #2
INTEGRATED CAPABILITIES
VISION (Concluded)

- Modeling and Simulation networks will be capable of high-speed transfer of large volumes of data from internetted systems
- Models and Simulations shall be scaleable, variable resolution, credible, allow real-time execution

TECHNICAL WORKING GROUP #2

CAPABILITIES NEEDS

- M&S community needs to access on-going efforts to develop multi-level security capability to ascertain if these efforts will meet specific needs of the M&S community
  - Network
  - Operating systems
  - Databases
  - DBMS
  - High encryption/decryption

TECHNICAL WORKING GROUP #2

CAPABILITIES NEEDS (Continued)

- Need to develop capability to interface different DBMS
  - Object Oriented vs RDBMS (etc)
- Need a system that will translate between different definitions and formats
- Need tools and methodologies to rapidly VV&A databases
- Develop capability to selectively access/interface/distribute data from different systems/models including full text

TECHNICAL WORKING GROUP #2

CAPABILITIES NEEDS (Continued)

- Establish interoperability standards
- Establish portability standards
- Publish/train/implement standards in M&S architecture
- Continue to coordinate and manage the identification and investigation of new technology for M&S and communicate to community (Use focal points)

TECHNICAL WORKING GROUP #2

CAPABILITIES NEEDS (Continued)

- Need to provide transparent, higher speed, higher capacity network capable of transmitting data in real time to meet special T&E needs
- Establish portability standards
- Publish/train/implement standards in M&S architecture
- Continue to coordinate and manage the identification and investigation of new technology for M&S and communicate to community (Use focal points)

TECHNICAL WORKING GROUP #2

CAPABILITIES NEEDS (Concluded)

- Need to develop a VV & A process for a future vision that stresses both stand alone and interoperable distributed simulations.
- T&E M&S need to be developed or modified to evaluate systems in their intended operational environments to include non-traditional systems (e.g., space systems) and missions

TECHNICAL WORKING GROUP #2

INTEGRATED ARCHITECTURE VISION

- M&S developed using sound software engineering principles for open system architecture using standards which support user requirements
- Standard protocols for networking to ensure interoperability throughout DoD

TECHNICAL WORKING GROUP #2

ARCHITECTURE NEEDS

- Need ADA to be improved to support M&S requirements
- Until ADA is improved, the community needs language flexibility to support parallelism, graphics user interfaces, better I/O, multi tasking, affordable compilers (etc)
- Develop open-system architecture standards to support M&S

TECHNICAL WORKING GROUP #2

ARCHITECTURE NEEDS (Continued)

- Develop standard protocols for networking to ensure interoperability throughout DoD
- Develop standard interfaces for selected classes of model subsystems (used throughout the T&E process to promote software reusability and agency collaboration

TECHNICAL WORKING GROUP #2

ARCHITECTURE NEEDS (Continued)

- Develop standard models for selected classes of functions (e.g., environment: terrain, multi-spectral clutter, weather, EM propagation,obscurants, human behavior) used throughout the T&E process to promote software reusability, agency collaboration, and eliminate duplication of effort

TECHNICAL WORKING GROUP #2

INFRASTRUCTURE NEEDS

- Fix responsibility for T&E M&S technology development on specific DoD Centers of Excellence
- Designate dedicated service/agency focal points for M&S
- Establish DoD baseline training levels for M&S professionals
  - Make SEI-like training affordable and available to community

TECHNICAL WORKING GROUP #2

INFRASTRUCTURE NEEDS (Continued)

- Establish DoD/Service clearing houses for M&S and database information
- Develop an automated means for the members of the M&S community to communicate and retrieve the information from clearing houses
- Establish DoD baseline training levels for M&S professionals
  - Make SEI-like training affordable and available to community

TECHNICAL WORKING GROUP #2

INFRASTRUCTURE NEEDS (Concluded)

- Develop an affordable high speed, multi-level secure network connecting T&E facilities.

TECHNICAL WORKING GROUP #2

INTEGRATED INFRASTRUCTURE VISION

- Capitalize on DoD development of Centers of Excellence for M&S technology
- Centralized dedicated focal points for M&S for each service/agency
- Personnel training for managers, analysts, engineers to establish a corps of M&S professionals
- Accessible means to identify and acquire information about M&S and databases
- Affordable high speed multi-level secure network connecting T&E facilities

APPENDIX K

INTEGRATED VISION AND NEEDS

TECHNICAL WORKING GROUP 3

INTEGRATED VISIONS AND NEEDS

INFRASTRUCTURE

- Free on-line databases of:
  - models and simulators
  - terrain and environmental data

  These would include:
  - indexes
  - descriptions
  - access procedures

TECHNICAL WORKING GROUP #3

INFRASTRUCTURE (Cont'd)

- Open BB/exchange media, including
  - models
  - simulations
  - environmental data
  - terrain
  - signatures
  - vulnerabilities
  - performance characteristics
- On-line help
- Model/Simulator user groups
- Simple global network control center(s)

TECHNICAL WORKING GROUP #3

INFRASTRUCTURE (Cont'd)

- Reconfigurable network with traceability
- Tracking system for capturing and certifying system test configurations
- Open multi-vendor distributed processing support
- Self documenting code

TECHNICAL WORKING GROUP #3

INFRASTRUCTURE (Conc'd)

- Better characterization of
  - command & control
  - environments
  - intelligence fusion
  - electromagnetic/acoustic warfare
  - human decision making
- Relation of the above to combat effectiveness

TECHNICAL WORKING GROUP #3

ARCH, STANDARDS AND PROTOCOLS

- Databases with standardized
  - data dictionary and nomenclature
  - sources and confidence levels
  - access levels
    - security
    - need-to-know
- Databases and models with improved
  - distributability
  - reuse
  - interoperability
  - reconfigurability
  - accessibility

TECHNICAL WORKING GROUP #3

ARCH, STANDARDS AND PROTOCOLS (Cont'd)

- Supports different execution modes
  - real-time
  - non real-time
- Standardized model analysis and architecture design methodology
- Easy data storage
- Multi-level network security and control
- Automated scenario generation

TECHNICAL WORKING GROUP #3

ARCH, STANDARDS AND PROTOCOLS (Cont'd)

- A more efficient model V&V process through:
  - automation (e.g., CASE)
  - sharing validation data
  - configuration management/management audit
- Standardized communications protocols including:
  - multi-rate
  - multi-cast
  - varying bandwidth (e.g., underwater)

TECHNICAL WORKING GROUP #3

ARCH, PROTOCOLS AND STANDARDS (Conc'd)

- Open 2D/3D visualization standards with reusable military graphic building blocks
- Easy data storage
- Visual programming/code generation, with automated consistency checking
- New visualization applications for:
  - briefing/rapid debriefing
  - systems operations/control
  - data extraction and analysis

TECHNICAL WORKING GROUP #3

CAPABILITIES

- Open multi-vendor distributed processing
- Open visualization standards and building blocks
- Visual programming/code gen with consistency
- Self documenting code
- Multi-level network security and control
- Reconfigurable network with traceability
- Standard comm protocols

TECHNICAL WORKING GROUP #3

CAPABILITIES (Conc'd)

- Better models: environment, intel, C2, human, EW-AW
- Better accommodation of varying resolution
- More efficient model V&V
- Test configuration tracking and certifying
- New visualization applications
- Automated scenario generator

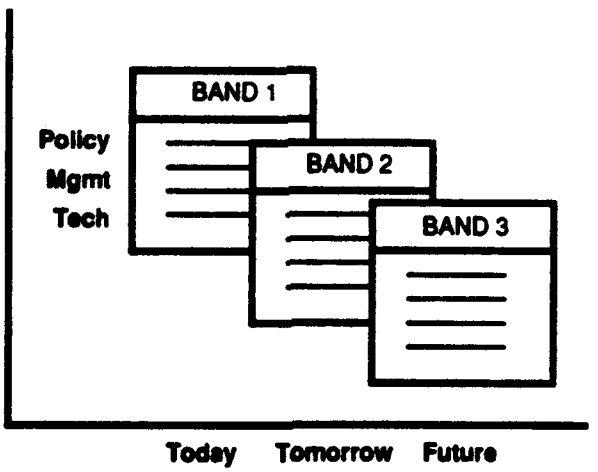
APPENDIX L

POLICY NEEDS

POLICY WORKING GROUP

POLICY NEEDS

PRIORITIZATION METHOD



T&E M&S REQUIREMENTS WORKSHOP

PRIORITY BANDS

- **BAND 1: Things that should be done and funded now**
- **BAND 2: Things that are important in the near term but can be done and funded in phases**
- **BAND 3: Things that are needed in the future but may need further development**

T&E M&S REQUIREMENTS WORKSHOP

POLICY: BAND 1

- **Establish central M&S authority to which all T&E M&S activities must report**
- **Develop a Master Plan to use M&S for T&E**
- **M&S should be used to support the T&E process throughout the system life cycle**
  - **V&V design requirements**
  - **development to deployment**
  - **operational assessments**

T&E M&S REQUIREMENTS WORKSHOP

POLICY: BAND 1 (concluded)

- DoD components shall establish V, V&A policy, procedures, and responsibilities
- Training: A M&S career track will be established, to include M&S course work
- Share models and data across DoD
- Standardized data definitions
- Standard database elements

T&E M&S REQUIREMENTS WORKSHOP

POLICY: BAND 2

- All M&S used in support of T&E will be accredited by the user
- M&S should be developed using a common open systems architecture using associated standards and protocols
- Architecture, standards, and protocols must provide for variable fidelity (as dictated by user needs)

T&E M&S REQUIREMENTS WORKSHOP

POLICY: BAND 2 (cont'd)

- M&S Software should meet established standards and metrics (i.e., MIL-STD-2167A, Army Software Test and Evaluation Panel process,...)
- M&S users/developers shall use valid data
- M&S developers will coordinate data requirements with DoD Offices of Primary Responsibility prior to expenditure of funds

T&E M&S REQUIREMENTS WORKSHOP

POLICY: BAND 2 (cont'd)

- Require the use of standard databases (i.e., intel, terrain, atmosphere, climate,...)
- Producers of standard databases will comply with standard database elements definitions
- Establish "library" of validated M&S modules (at DoD or Service levels)
- Establish central M&S "Lessons-Learned" Library
- Encourage distributed, real-time processing with Man-in-the-loop/HW-in-the-loop capability

T&E M&S REQUIREMENTS WORKSHOP

POLICY: BAND 2 (concluded)

- M&S should be used when live tests are limited or cannot be conducted
- The contractor should provide non-proprietary deliverable software packages

T&E M&S REQUIREMENTS WORKSHOP

POLICY: BAND 3

- M&S will be designed/modified with the following in mind: portability, interoperability, credibility, usability, flexibility, reusability, internetting and security, and linking.
- All M&S architectures should have the capability to import and export standard databases produced by DoD Offices of Primary Responsibility
- M&S will consist of a standardized documented version which will remain intact; changes to the standard will occur to other versions

T&E M&S REQUIREMENTS WORKSHOP

POLICY: BAND 3 (cont'd)

- Internet should be capable of providing data links for sub-surface/surface/air/space
- M&S will allow vertical and horizontal integration (e.g., Aggregate Level Simulation Protocol)
- Capable of playing roles in joint-service scenarios providing essential degree of realism
- Perform real-time data collection, reduction, visualization, and distribution

T&E M&S REQUIREMENTS WORKSHOP

POLICY: BAND 3 (concluded)

- Establish high volume networks for transfer of multi-level classification test data
- M&S shall relate test results to combat effectiveness and battle outcomes

APPENDIX M

MANAGEMENT NEEDS

MANAGEMENT WORKING GROUP

MANAGEMENT NEEDS

MANAGEMENT: BAND 1

- Promote early involvement by management, user, developer
- Provide resources
- Establish service proponency
- Standardize:
  - architecture
  - databases
  - definitions
  - documentation
- Standardize VV&A Process

T&E M&S REQUIREMENTS WORKSHOP

MANAGEMENT: BAND 2

- Provide relief or waivers from ADPE and communications network equipment procurement regulations
- Provide centralized coordination and allow for decentralized execution
- Expand to all phases of T&E
- Educate
  - publicize
  - train
- Develop and use multi-service expertise
- Distribute products

T&E M&S REQUIREMENTS WORKSHOP

MANAGEMENT: BAND 3

- Develop & maintain models/databases
- Improve network
- Establish multi-level security capability
- Recognize and coordinate new technology insertion

T&E M&S REQUIREMENTS WORKSHOP

POLICY & MANAGEMENT CONCLUSION

- From a Policy and Management perspective, Modeling and Simulation in support of T&E should:
  - Reduce costs
  - Reduce risks
  - Increase efficiency
  - Reduce schedules
  - Improve T&E process credibility

APPENDIX N

TECHNICAL NEEDS

TECHNICAL WORKING GROUP

TECHNICAL NEEDS

M&S AND DATA MANAGEMENT NEEDS

Band 1

- Establish clearing houses/repositories (free and easy access, bulletin boards)
- Develop & disseminate M&S standards
- Establish M&S user group

T&E M&S REQUIREMENTS WORKSHOP

M&S PROCESS NEEDS

Band 1

- Place responsibility for T&E M&S technology development on specific DoD Centers of Excellence
- Designate dedicated service/agency focal points for M&S
  - centralized management
  - decentralized execution
- Involve warfighter and T&E M&S communities early in acquisition processes

T&E M&S REQUIREMENTS WORKSHOP

M&S VV&A NEEDS

Band 1

- Establish VV&A process that provides:
  - standardized documentation
  - formal Configuration Management
  - shared information

T&E M&S REQUIREMENTS WORKSHOP

M&S VV&A NEEDS

Band 2 • **Develop automated V&V processes and support tools**

Band 2 • **Develop a VV&A process for the future that stresses both stand-alone and interoperable distributed simulations**

T&E M&S REQUIREMENTS WORKSHOP

M&S PROFESSIONAL DEVELOPMENT NEEDS

Band 2

- **Establish DoD baseline training levels for M&S professionals**
- **Establish grade structures/skill requirements/career paths**
- **Establish appropriate training programs for M&S professionals and practitioners within the T&E community**
- **Make training affordable and available to community (e.g., Software Engineering Institute)**

T&E M&S REQUIREMENTS WORKSHOP

MODEL AND SIMULATION NEEDS

Band 2

- Develop standard models for selected classes of functions used throughout the T&E process to promote software reusability, agency collaboration, and eliminate duplication of effort
  - terrain
  - multi-spectral clutter
  - weather
  - EM propagation
  - human behavior
- Relate system measures of performance to combat effectiveness/battle outcome

T&E M&S REQUIREMENTS WORKSHOP

MODEL AND SIMULATION NEEDS (continued)

Band 2

- Encourage M&S development with the following attributes:
  - very high fidelity
  - varying resolution/scale/scope
  - interoperability (between models)
  - robust capability
    - multi-spectral
    - soft kill/hard kill
  - ease of use
  - standardized portability

Where it makes sense

T&E M&S REQUIREMENTS WORKSHOP

MODEL AND SIMULATION NEEDS (Concluded)

Band 2

- object-oriented and open systems architecture
- real-time operations
- man-in-the-loop
- hardware-in-the-loop
- distributability
- reuse
- reconfigurability
- accessibility

Where it makes sense

T&E M&S REQUIREMENTS WORKSHOP

M&S INTERFACE NEEDS

Band 2

- Establish data interface standards to include:
  - data definition
  - format
  - joint data/object dictionary
- Establish data interface standards with capability for:
  - on-line test cases
  - network and stand-alone

T&E M&S REQUIREMENTS WORKSHOP

M&S INTERFACE NEEDS (Concluded)

Band 2

- Develop standard interfaces for selected classes of model subsystems (used throughout the T&E process) to promote software reusability and agency collaboration

T&E M&S REQUIREMENTS WORKSHOP

M&S DATABASE NEEDS

Band 2

- Develop improved capability for M&S databases to include:
  - standardized data definitions and formats
  - common data on-line dictionary
  - intelligent access procedures
  - validation audit trail
  - Configuration Management, maintenance and distribution
  - multi-level security
  - accessibility
  - multi-level fidelity

M&S DATABASE NEEDS (Concluded)

BAND 2

- Establish common/shared databases for common threat, environment, terrain, validation test data, etc.

M&S NETWORK NEEDS

Band 2

- Develop an affordable high speed, multi-level secure network connecting T&E facilities from existing networks
- On-line knowledge-based asset manager
- Reconfigurable network with traceability

T&E M&S REQUIREMENTS WORKSHOP

M&S NETWORK NEEDS (Concluded)

Band 2

- Establish improved network capabilities in the areas of:
  - net management
  - asset readiness check
  - standardized cost procedures
  - tunable data rates
  - minimum latency
  - embedded multi-level security
  - on-line context-sensitive help

T&E M&S REQUIREMENTS WORKSHOP

M&S TECHNOLOGY NEEDS

Band 2

- Focus M&S technology investments in
  - visual programming
  - visualization/imaging virtual reality
  - data compression
  - dynamic user-defined environment

T&E M&S REQUIREMENTS WORKSHOP

M&S SOFTWARE DEVELOPMENT NEEDS

Band 3

- Support standard SW development methodology with SW support environment including automated documentation
- Support distributed execution across networks or massively-parallel systems

T&E M&S REQUIREMENTS WORKSHOP

M&S MULTI-LEVEL SECURITY NEEDS

Band 3

- M&S community needs access to on-going efforts to develop multi-level security capability to ascertain if these efforts will meet specific needs of the M&S community
  - Networks
  - Operating systems
  - Database Management Systems
  - High speed encryption/decryption

T&E M&S REQUIREMENTS WORKSHOP

M&S LANGUAGE NEEDS

Band 3 • **Need Ada to be improved to support M&S requirements**

T&E M&S REQUIREMENTS WORKSHOP

M&S LANGUAGE NEEDS

Band 1 • **Until Ada is improved, the community needs language flexibility to support parallelism, graphics user interfaces, better I/O, multi-tasking, affordable compilers, etc.**

APPENDIX O

OVERVIEW OF REQUIREMENTS SURVEY FOR TEST AND EVALUATION MODELING AND SIMULATION

Overview of Requirements Survey for Test and Evaluation (T&E) Modeling and Simulation (M&S)

Background

On 21 June 1991 Deputy Secretary of Defense signed a memorandum which directed that DoD make more effective use of models and simulations. This memo assigned responsibility to Under Secretary of Defense (Acquisition), with advice from the Executive Council for Modeling and Simulation (EXCIMS).

One goal of the Defense Modeling and Simulation (M&S) initiative is to invest in joint high-return M&S activities.

EXCIMS investment guidance includes the following objectives:

- Promulgate Standards to Promote Interoperability of the components of the M&S Environment
- Support development of databases, tools and methodologies for community-wide use

Background (Cont'd)

- Promote Development of a Communications Infrastructure to Support Integration of Joint Modeling and Simulation Activities
- Facilitate Community-Wide Coordination and Information Sharing
- M&S needs and capability gaps were not well defined for use in judging M&S proposals for FY 91/92 DMSO funding
- M&S requirements survey gathered information needed to further define needs/capability gaps directly from T&E community

Survey Goals

Gather information on T&E M&S needs from M&S developers and users to use as input to the T&E M&S Workshop.

Results of survey will help answer:

- Which M&S investments will most benefit T&E community (short term and long term)?
- How can investments in M&S activities help solve T&E problems and reduce net costs of T&E
- What policy/management issues should be addressed to improve effectiveness of M&S used for T&E?

Specific Objectives of M&S Survey

- Determine current and long-range problems / limitations / capability-gaps (expressed by multiple services) in existing models and simulations.
- Determine how we can exploit advances in technologies (e.g. Networks) to "improve" M&S for T&E in multiple services.

  "improve" M&S for T&E means reduce net cost, increase safety, improve security, reduce environmental impact and/or improve thoroughness of T&E through M&S.

- Determine other M&S-related activities that would "improve" application of M&S for T&E in multiple services.
- Provide a basis with which to enter the T&E Requirements Workshop.

Survey Execution

- Prepared introductory briefing and designed a questionnaire
- Sent questionnaires to eleven T&E sites and entered information from completed questionnaires into database
- Held on-site meetings with questionnaire respondents (focus groups) to dialogue and expand on information in questionnaires
- Analyzed and summarized information gathered during survey

T&E Survey Sites

- NAWC AD, PAX River (Navy)
- TECOM and TRAC, White Sands Missile Range (Army)
- NAWC WD, China Lake (Navy)
- NAWC WD, Point Mugu (Navy)
- Aerospace Corp. and Edwards AFB, Los Angeles (Air Force)
- AFOTEC, Kirkland Air Force Base
- TEXCOM/OPTEC, Fort Hood (Army)
- USAEPG, Fort Huachuca (Army)
- MSIC, Redstone Arsenal (DIA)
- Eglin AFB (video teleconference

Analysis of Survey Information

- Analyzed data from questionnaires to identify multiservice issues and determine how side-spread these issues are
  - Identified "key phrases" (reflecting management issues, policy issues and technical issues) from each questionnaire and from focus group meeting notes
  - Counted number of occurrences of each key phrase--if a key phrase (or equivilant words reflecting the same issue) appeared one or more times in a questionnaire or was mentioned one or more times during a focus group meeting, that was counted as one occurrence for that key phrase
- Counted occurrences of each level of ranking for the items (suggested M&S needs and issues) listed in prioritazation tables of questionnaires

Summarizing Survey Results

- Summarized key phrases (issues)
  - Grouped key phrases into management, policy and technical issues
  - Listed each group of key phrases in order of decreasing numbers of occurrences (key phrases with more occurrences ahead of key phrases with fewer occurrences)
  - A key phrase had to occur in questionnaire and/or focus group discussions from two or more services/agencies to be included in summary information
  - Replaced each key phrase with the issue that it reflects and gave an explanation of the issue when appropriate
  - Factored prioritization (ranking) data from survey questionnaires into summary information

Summarizing Survey Results (Cont'd)

Policy	Management	Technical

- The summaries of survey results have been provided to chairmen of the working groups
  - Issues will be expanded upon and prioritized during working group discussions